

**bon oxidati n r a ti ns.**

**Brief Summary Text - BSTX:**

**Sol-gel methods are often used to produce thin films but sol-gel processing generally suffers from limitations due to the relative solubilities of the various metals salts and metal alkoxides. Therefore, the starting materials are often modified to permit adequate solubility, adding processing steps to the method. These methods generally require synthesis of novel starting materials, relatively long mixing times, and/or heating during preparation of the desired precursor solutions. Miller et al., in U.S. Pat. No. 5,116,643, issued on May 26, 1992, as well as in U.S. Pat. No. 4,946,710 issued on Aug. 7, 1990, and in U.S. Pat. No. 5,028,455 issued on Jul. 2, 1991, describe a sol-gel method for producing ferroelectric thin films using alcohol and acid solvents in proportions sufficient to ensure equal reaction rates. However, Miller et al. also require heating to drive off the solvent, the addition of further reagents to quench reactivity and the introduction of water to hydrolyze the produced precursors.**

**Brief Summary Text - BSTX:**

**Tomita (U.S. Pat. No. 5,256,443, i**



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**May 9, 2002**(54) **PIEZOELECTRIC ELEMENT, PROCESS FOR PRODUCING THE SAME AND INK JET RECORDING HEAD**

(52) U.S. Cl. .... 310/358; 29/25.35; 252/62.9 PZ

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**ABSTRACT**

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Washington, DC 20036-5339 (US)**(73) Assignee: **KANSAI RESEARCH INSTITUTE**(21) Appl. No.: **09/741,833**(22) Filed: **Dec. 22, 2000**(30) **Foreign Application Priority Data**

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Provided are a piezoelectric element by which a pressure of a better displacement is obtained, a process for producing the same and an ink jet recording head having the piezoelectric element.

A piezoelectric element comprising a substrate (2), a lower electrode (3) formed on the substrate (2), piezoelectric film (7) [(4)(5)(6)] each containing  $\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$  ( $0 < x < 1$ ) and a valence compensation-type perovskite represented by formula  $\text{Pb}(\text{A}_{1/3}\text{B}_{2/3})\text{O}_3$  (wherein A and B each represent a valence compensation-type perovskite) as basic components formed on the lower electrode (3), and an upper electrode (8) formed on the piezoelectric film (7). In the piezoelectric film, the concentration of A and/or B is changed in the thickness direction of the piezoelectric film, and the maximum value of the concentration of A and/or B is shown in a region within 60% from the upper electrode side in the thickness direction of the piezoelectric film. It is suited for an ink jet recording head.

